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THERMAL EFFECTS ON FLOW (TEF)
KEY TECHNICAL ISSUE (KTI)

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NRC/DOE TECHNICAL EXCHANGE

PRE-LICENSING ISSUE RESOLUTION STATUS

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TEF KTI SUBISSUES

SUBISSUE 1: IS THE U.S. DEPARTMENT OF ENERGY THERMOHYDROLOGIC TESTING PROGRAM, INCLUDING PERFORMANCE CONFIRMATION TESTING, SUFFICIENT TO EVALUATE THE POTENTIAL FOR THERMAL REFLUX TO OCCUR IN THE NEAR FIELD?

Status: Open

SUBISSUE 2: IS THE U.S. DEPARTMENT OF ENERGY THERMOHYDROLOGIC MODELING APPROACH SUFFICIENT TO PREDICT THE NATURE AND BOUNDS OF THERMAL EFFECTS ON FLOW IN THE NEAR FIELD?

Status: Open

SUBISSUE 3: DOES THE U.S. DEPARTMENT OF ENERGY TOTAL SYSTEM PERFORMANCE ASSESSMENT ADEQUATELY ACCOUNT FOR THERMAL EFFECTS ON FLOW?

Status: Open

TEF KTI SUBISSUE's 1, 2, and 3

Relationships between DOE Key Attributes and NRC Abstractions

- **DOE RSS Key Attributes of Repository System:**
  - **Limited Water Contacting Waste Package**
    - **3. UZ flow above repository (Ranking 1, Confidence B)**
    - **4. Seepage into drifts (Ranking 2, Confidence C)**
    - **5. Coupled processes-effects on UZ flow and seepage (Ranking 1, Confidence C)**
    - **6. Water distribution and removal-moisture on drip shield (Ranking 1, Confidence C)**
    - **7. Physical and chemical environment-environment on drip shield (Ranking 1, Confidence C)**
    - **8. EBS degradation-degradation of drip shield (Ranking 2, Confidence C)**
  - **Long Waste Package Lifetime**
    - **9. Water distribution and removal-moisture on waste package (Ranking 2, Confidence C)**
    - **10. Physical and chemical environment-environments on waste package (Ranking 2, Confidence C)**
- NRC Abstractions
  - Near-Field Heat Transfer and Temperature Calculation
  - Near-Field Groundwater Infiltration
  - EBS Failure, Humid Air and Aqueous Corrosion.
  - EBS Release, Water Dripping Abstraction.

Summary -- TEF KTI SUBISSUE 3

- Assess the effect of water contacting waste packages during the thermal period **or** provide technical bases that this will not occur **or** will not adversely effect repository performance. (a)

- Assess the effects of all relevant repository design features such as: thermal loading, ventilation, and drip shield in evaluating waste package conditions (Temperature, Pressure, Relative Humidity). (a)

- Assess the effect on water flow (i.e permeability changes) of coupled thermal-hydrological-mechanical-chemical processes **or** provide technical bases that these effects are bounded **or** can be safely excluded. (a)

- Demonstrate that results of performance assessments related to TEF are consistent with process-level models. (a)

a	Additional analyses
b	Additional data and analyses

Summary -- TEF KTI SUBISSUE 2

- Process-level conceptual and mathematical models should include: (a)
  - evaporation, condensation, and the effects of discrete features,
  - lateral movement of condensate, cold-trap effect, repository edge effects, and condensate drainage through fractures,
  - all significant repository design features (e.g. ventilation)
  - spatially variable infiltration,
  - adequate heterogeneity in media properties,
  - adequate representation of drift-wall geometry.

- Demonstrate that models are: (b)
  - consistent with physical observations from tests,
  - appropriate to the expected temperature regime.

- Assess the effect of permeability changes due to coupled thermal-hydrological-mechanical-chemical processes on water flow **or** show that these changes are not significant (a).

a	Additional analyses
b	Additional data and analyses

Summary -- TEF KTI SUBISSUE 1

- Account for the effects of mass and energy losses, from the heated drift to the connecting drift via the thermal bulkhead (and other boundary conditions), on condensate buildup above the heated drift, refluxing during heating, and condensate drainage back to the heated drift during heating and cooling. (b)

a Additional analyses
b Additional data and analyses